GENERATING OPTIONS FOR ROADSPACE ALLOCATION IN BUSY URBAN ROADS

Paulo Rui Anciaes
Peter Jones
Centre for Transport Studies, University College London

Presented at 19th Annual Transport Practitioners Meeting (TPM 2021), 7-8 July 2021

1. INTRODUCTION

Urban roads and streets have different uses: movement by different modes of transport (public or private, motorised or non-motorised), freight distribution, vehicle parking, waiting for buses, relaxing, socializing, provision of green space, surface water management, and others. Currently, urban roads and streets are under great pressure due to the need to accommodate increased mobility levels and 'just in time' deliveries and servicing, at the same time that governments are putting increased focus on developing attractive spaces to support active modes of transport and encouraging place activities, all within fixed road widths.

Despite the competing interests involved, decisions to reallocate roadspace are usually made on an ad-hoc political basis. In particular, the option generation stage tends to be omitted. The usual procedure in urban road (re)design processes is to present the public with a small set of possible options, for consultation. These options are not the result of a systematic process.

To fill this gap, we developed two web-based tools for the generation of options for roadspace reallocation (currently at https://more.traffwebdev.uk, from 2022 at https://www.roadspace.eu). The tools assist planners to explore feasible solutions that consider the needs of all road uses and a range of economic, social, and environmental objectives. The *Policy Interventions* tool generates options for the static or time-based reallocation of roadspace, selected from a library of 210 types of interventions. The *Road Designs* tool generates detailed roadspace allocation designs, in cross section, combining different design elements.

The tools were created by the authors, with feedback from associations representing pedestrians, cyclists, and public transport users and from planners in five European cities (London, Lisbon, Budapest, Malmo, and Constanta). The tools were validated in real-world scenarios in the five cities and are now available for wider use in other cities.

2. POLICY INTERVENTIONS TOOL

The Policy Interventions tool generates options for broad types of interventions on urban roads and streets, including interventions that: 1) change the allocation of space among users, permanently: 2) change the allocation of space only at some times (e.g. evenings, weekends, holidays): 3) change the allocation of space dynamically, based on demand for

different uses at each time; 4) do not reallocate space among users but change the (physical or legal) conditions under which the road can be used. The tool contains 210 possible options, collected from the literature.

The figures below show the two inputs of the tool: the priorities assigned to each type of road use (Figure 1) and the objectives the intervention should achieve (Figure 2). There are three possible levels of priority to road uses: "0" (the conditions for that type of road use can deteriorate, if required to improve conditions for other road uses), "1", (the conditions should not deteriorate), or "2" (the conditions should improve). A maximum of five objectives can be chosen.

The list of possible road uses and objectives were compiled based on a review of the literature and discussions with project partners, including the five cities and associations representing pedestrians, cyclists, and public transport operators.

The list of road uses comprises different ways in which the road can be used by 15 types of users, both of non-motorised and modes of transport. This includes: pedestrians, pedestrians with restricted mobility, cyclists, micromobility users (scooters, skates, etc.), bus drivers, bus passengers, rail/metro/bus passengers, car drivers, car share users, motorcyclists, taxi drivers and passengers (including ride-hailing vehicles), and users of goods, emergency, and service vehicles. As example, pedestrians can use the road in five possible ways: walking, crossing the road, strolling, sitting on benches or other street furniture or sitting on cafés or other outdoor commercial spaces.

The list of objective covers objectives related to the movement and the 'place' functions of the road, operational aspects, and wider objectives (i.e. those that related to the benefits of costs of using the road), split into economic, social, and environmental objectives.

Figure 1. Policy Interventions tool input: Road use priorities

PRIORITIES

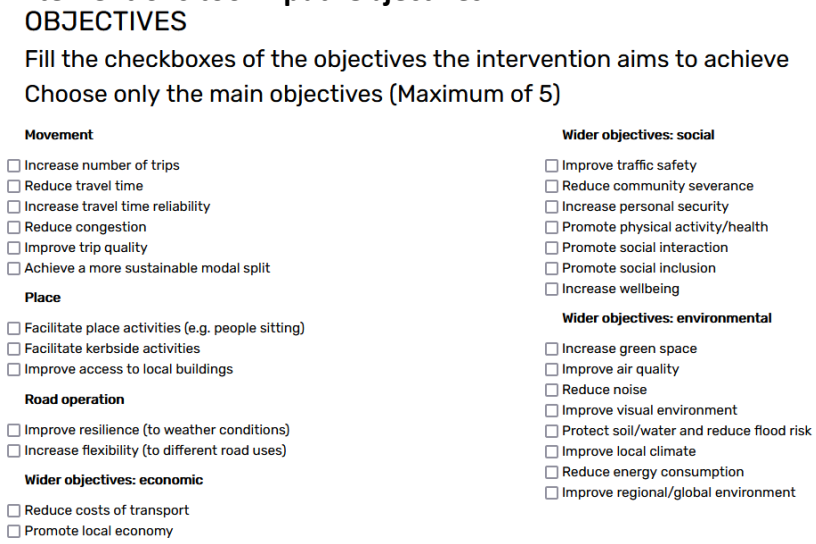
Choose from the green dropdown menus the degree of priority of each type of road user or road use

0 Can be worse off than now, if needed
1 Should not be worse off than now — Choose a maximum of 3 road uses with level 1
2 Should be better off than now — Choose a maximum of 3 road uses with level 2

Road user	Road use	
Pedestrians	Walk	0
	Cross the road	0
	Stroll	0
	Sit (street furniture)	0
	Sit (outdoor cafe)	0
Pedestrians with restricted mobility	Walk	0
	Cross the road	0
Cyclists	Move	0
	Park	0
	Rent (dock)	0
	Rent (dockless)	0
Micromobility users (scooters, skates, etc.)	Move	0

Road user	Road use	
Bus drivers	Move	0
	Stop	0
Bus Passengers	Interchange	0
	Wait	0
Rail/metro/bus passengers	Interchange	0
Car drivers	Move	0
	Park	0
	Stop	0
Car share users	Move	0
Motorcyclists	Move	0
Taxi drivers (inc. ride-hailing)	Wait	0
Taxi passengers (inc. ride-hailing)	Wait	0
Goods vehicles	Move	0
	Stop	0
Emergency vehicles	Move	0
Service vehicles	Move	0

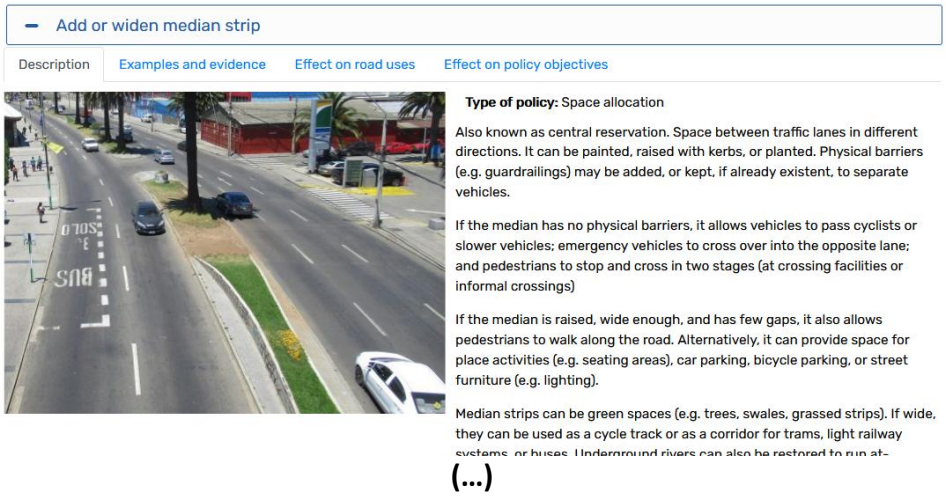
Figure 2. Policy Interventions tool input: Objectives



The tool returns a list of all interventions that fulfil the criteria specified in the inputs regarding road uses and objectives. This uses a query to the interventions database, which includes fields describing the likely effect of the interventions on road uses and objectives as positive, uncertain/neutral, or negative. This information was filled based, where possible, on empirical evidence collected from the literature. When evidence was not available, the likely effect was assigned based on the theory regarding the likely chain of effects of intervention, i.e. changes in the behaviour of all road users and possible consequences of those changes. The information was assigned by the authors and reviewed by project partners.

The tool shows, for each of the policies presented in the results list, four pages of information. The first page is a general description of the intervention, general design guidelines, and types of areas and roads where the intervention can be applied. Figure 3 shows an example of this page (for the "Add or widen middle strip" intervention). The second page (Figure 4) lists examples of the intervention around the world and the main effects identified in the literature, with references to the respective studies. The other two pages (Figure 5 and Figure 6) list the likely effect on all road uses and objectives.

Figure 3. Policy Interventions tool output: Example of *Description* page



(...)

Figure 4. Policy Interventions tool output: Example of *Examples and evidence* page

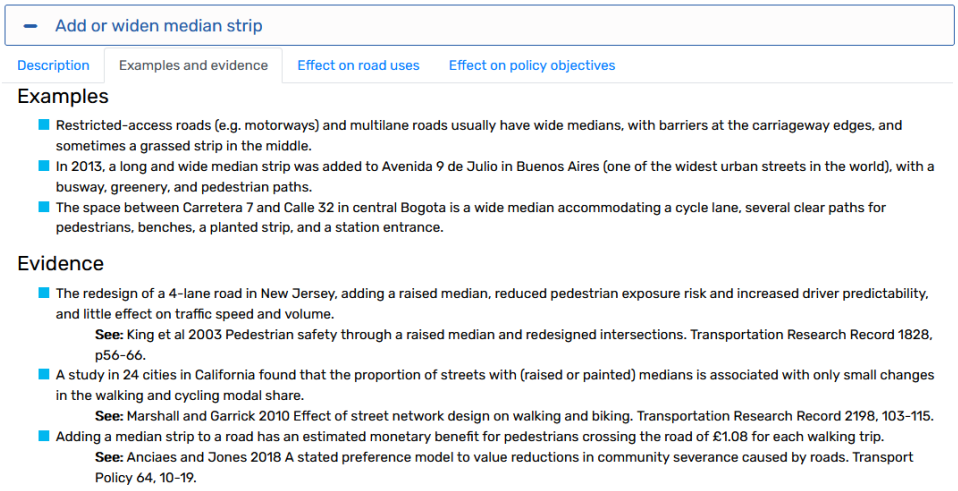
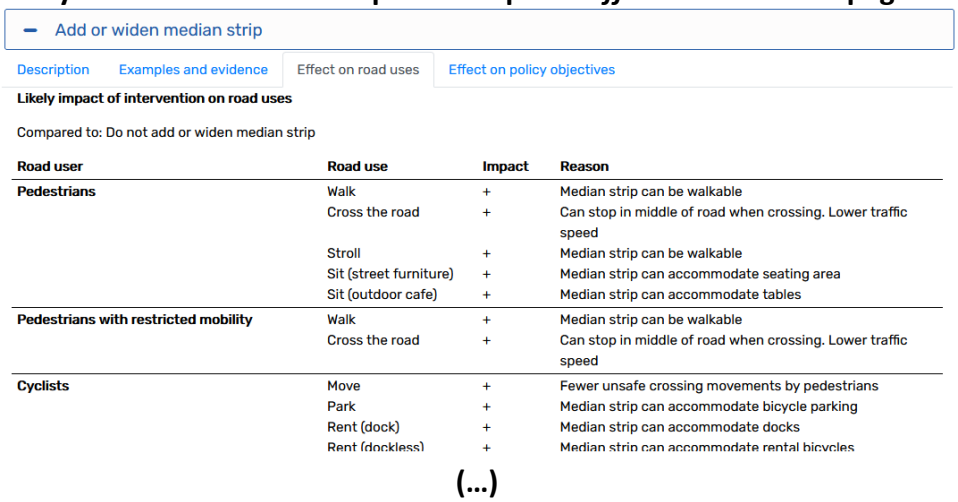
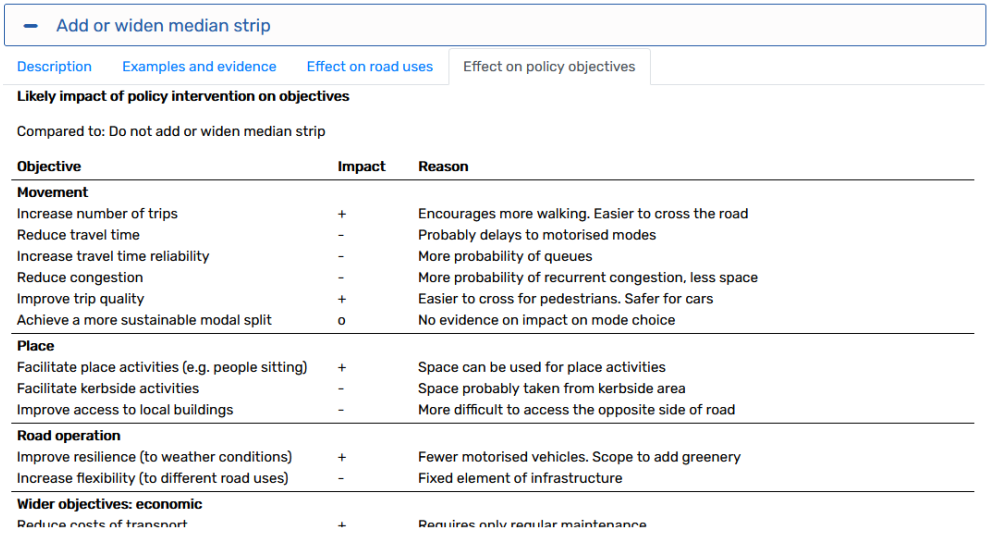


Figure 5. Policy Interventions tool output: Example of *Effect on road uses* page



(...)

Figure 6. Policy Interventions tool output: Example of *Effect on policy objectives* page



Add or widen median strip

Description | Examples and evidence | Effect on road uses | Effect on policy objectives

Likely impact of policy intervention on objectives

Compared to: Do not add or widen median strip

Objective	Impact	Reason
Movement		
Increase number of trips	+	Encourages more walking. Easier to cross the road
Reduce travel time	-	Probably delays to motorised modes
Increase travel time reliability	-	More probability of queues
Reduce congestion	-	More probability of recurrent congestion, less space
Improve trip quality	+	Easier to cross for pedestrians. Safer for cars
Achieve a more sustainable modal split	o	No evidence on impact on mode choice
Place		
Facilitate place activities (e.g. people sitting)	+	Space can be used for place activities
Facilitate kerbside activities	-	Space probably taken from kerbside area
Improve access to local buildings	-	More difficult to access the opposite side of road
Road operation		
Improve resilience (to weather conditions)	+	Fewer motorised vehicles. Scope to add greenery
Increase flexibility (to different road uses)	-	Fixed element of infrastructure
Wider objectives: economic		
Reduce costs of transport	+	Requires only regular maintenance

(...)

The Policy Interventions tool fills a gap in decision-support methods available to practitioners, as the information of possible interventions is currently scattered across studies that focus on specific street uses or objectives. The new tool organizes the existing information, and classifies it consistently (using the same fields for all the interventions in the database). This is useful for planners as it provides a clear comparison between the advantages and disadvantages of each type of intervention.

3. ROAD DESIGNS TOOL

The Road Designs tool generates detailed options for roadspace allocation options, represented as cross-sectional designs. These are combinations of nine types of design elements: space for walking, space for place activities (e.g. stalls, benches, outdoor cafés), green area, lane for general traffic, bus lane, space for cycling (cycle lane or cycle track), mixed bus and cycle lane, space for parking and loading, and tram lines.

The possible widths of each element were assigned in the tool database considering information from design guidelines in the five partner cities. Each type of element can assume two possible sizes (e.g. minimum standards or wider) and be placed in 13 different positions across the road (3 in the left-side footway, 2 in the left-side carriageway, 3 in the middle strip, 2 in the right-side carriageway and 3 in the right-side footway). The width of some elements depends on their position across the road and on the type of design elements that are placed next to them. For example, cycle lanes or tracks are wider when they are in the middle strips, surrounded by lanes of moving traffic.

The tool contains 30,300 possible options. These are all combinations of the nine types of design elements (which can assume different widths) that fit in roads with widths between 15 and 35 metres. Unfeasible designs were excluded. For example, designs where the lanes for the movement of cars or buses are at the edge of the road, without footways separating them from buildings.

The figures below show the two inputs of the tool: the width currently allocated to each type of design element (Figure 7) and the desired priorities of each design element (Figure 8). There are three possible levels of priority to design elements: "0" (Not relevant - no space provided), "1" (Relevant, but not priority - will have some space but not more than now), or "2" (Relevant and priority - will have at least the same space but more, if possible).

Figure 7. Example of Road Designs tool input: current situation

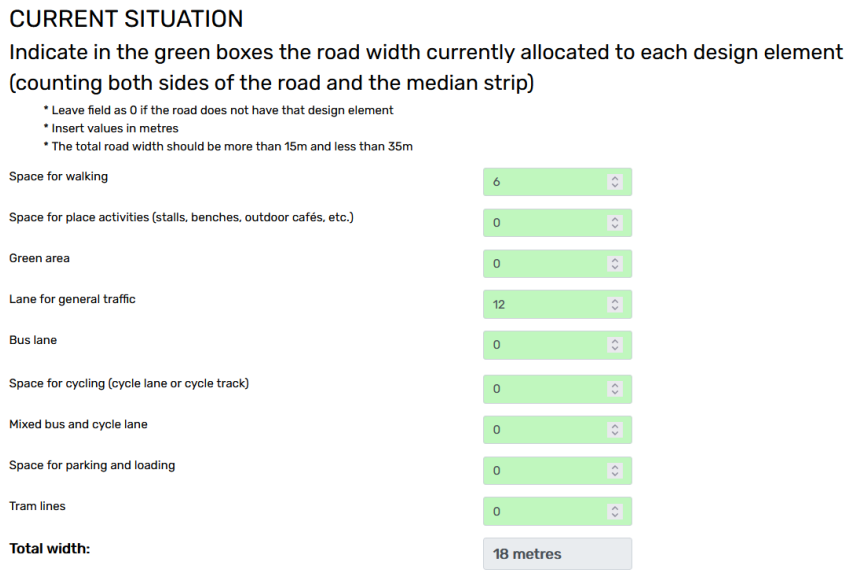
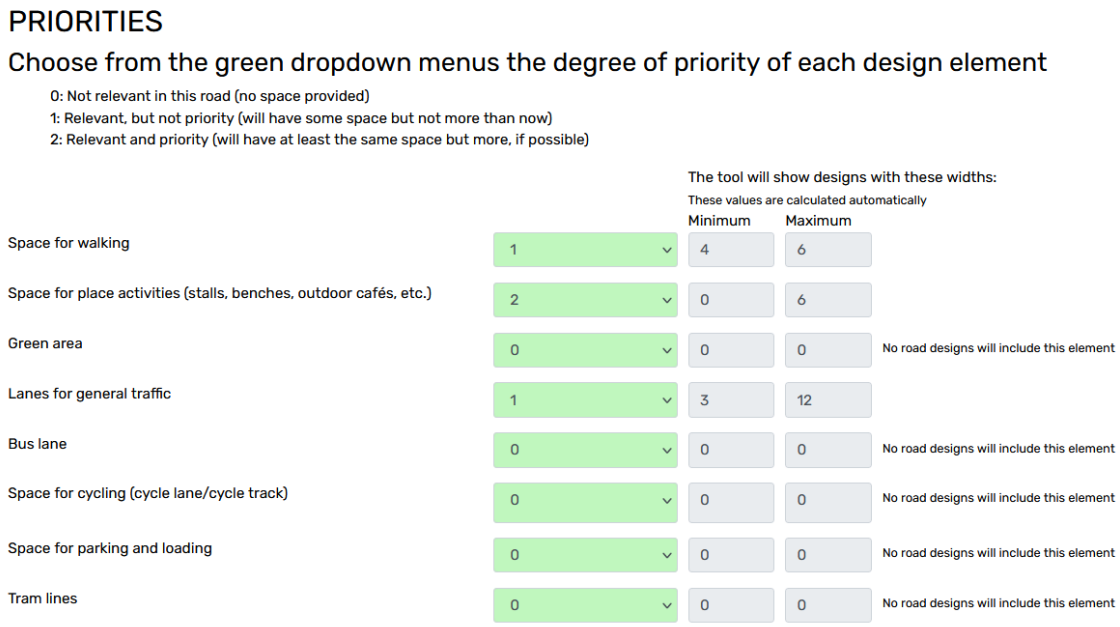


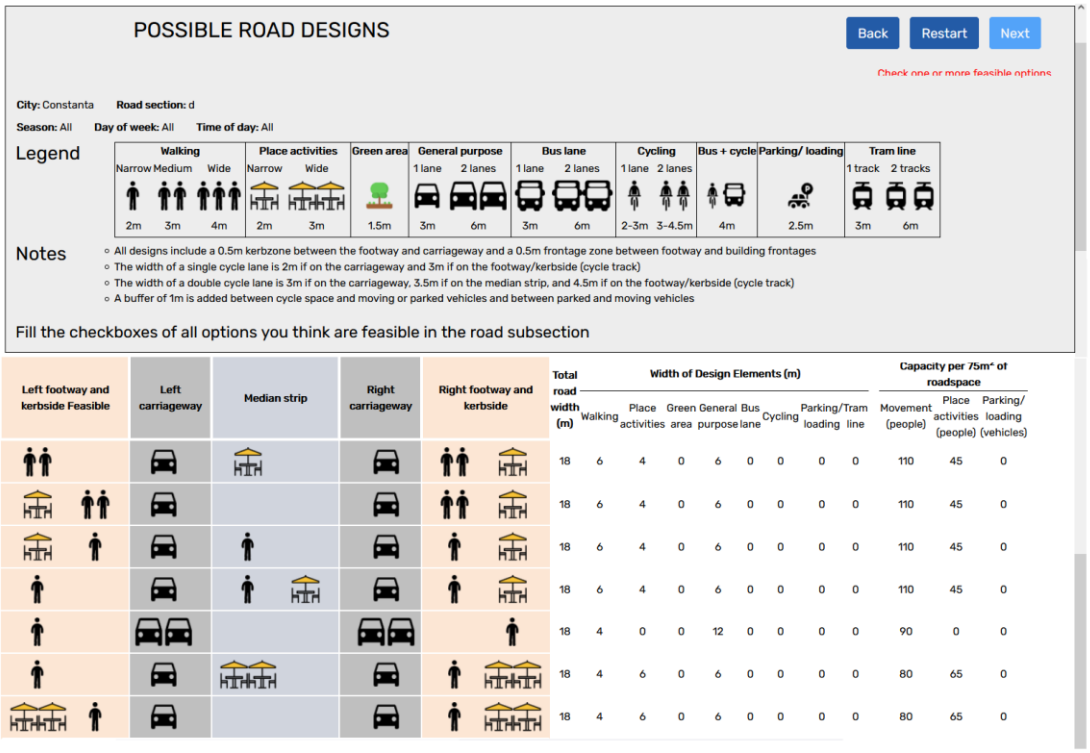
Figure 8. Example of Road Designs tool input: priorities



The tool returns a list of all designs (i.e. combinations of design elements) that fulfil the priorities specified in the inputs and fit in the available road width. Figure 9 shows an example of the tool output (for the inputs specified in the previous figures). In this case, the tool returns seven possible options. The design elements are identified by icons. Each design includes the total road width assigned to each type of design element, and estimates of the

road capacity (per 75m2 of street space) assigned to movement (by any mode of transport), to place activities and to parking and loading.

Figure 9. Example of Road Designs tool output



The Road Designs tool fills a gap in existing methods by considering the full range of combinations of design elements that can be feasibly accommodated in a road. Some of these combinations may be less obvious and thus may not usually be considered by planners. However, these options may not only be feasible but also be aligned with the priorities that governments feel that need to be assigned to some road uses.

4. CONCLUSIONS

The two tools provide planners with an objective and systematic means to generate a comprehensive set of options for redesigning urban roads and reallocating space from one type of use to another. The set of options generated balance different user needs and policy objectives, taking into account existing constraints. This existence of this balance in the option generation stage contributes to the political feasibility and public acceptance of the options in the final decision stage. The tools are also openly available to the general public, increasing the transparency of the process.

ACKNOWLEDGMENTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 769276.